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I, JANENE PEISKER, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2004900349 for a patent by SCHEFENACKER VISION SYSTEMS AUSTRALIA PTY LTD as filed on 28 January 2004.

WITNESS my hand this  
Eighth day of February 2005

A handwritten signature in black ink, appearing to read "J. K. Peisker".

JANENE PEISKER  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



SCHEFENACKER VISION SYSTEMS AUSTRALIA PTY LTD

AUSTRALIA  
PATENTS ACT 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:

**"POWERED TELESCOPING VEHICLE EXTERNAL MIRROR"**

This invention is described in the following statement:

## FIELD OF THE INVENTION

The present invention relates to powered telescoping vehicle external mirrors.

## BACKGROUND TO THE INVENTION

5 For vehicles and in particular for sport utility type vehicles, it is desirable to be able to move a mirror head which holds the mirror with respect to a mounting bracket on the vehicle away from or back towards the mounting bracket. This enables the mirror head to be positioned either close to the side of the motor vehicle, or to be extended away from the motor vehicle. In its extended position, an increased 10 (wider) useful field of view behind the vehicle is provided. This is important where the rear view may be obstructed by a load on the vehicle or a trailer that is being towed for instance.

Various powered telescoping external vehicle mirrors have been developed.

15 For larger mirrors twin telescopic arms are commonly used. With some designs, the twin arms each comprise a hollow outer arm and an inner arm. The hollow outer arm is connected to the bracket and the inner arm is connected to the mirror head. By making the outer arm hollow, a light weight yet strong construction can be achieved. In order to keep the mirror head compact and to take advantage of the internal space 20 defined by the hollow outer arms, drive components and stabilising components are advantageously mounted on the inner arm for action against the inside of the outer arm. A difficulty with this design arises in coordination of the drive of the two arms to ensure that skewing and jamming does not occur. Where a single drive motor is employed, a further difficulty arises in transferring the output of a single drive motor 25 to drive components within the inner arms. Two designs developed by the applicant formed the subject of earlier filed International Patent Application Nos. PCT/AU00/00077 and PCT/AU02/01237. In the first of those patent applications, a system employing cables extending from the head into the arm is disclosed. In the second International patent application, a flexible toothed belt extends from the head 30 into the arm.

It is an object of the present invention to provide an improved and simplified power telescoping vehicle external mirror assembly that overcomes at least some of the above problems.

## 5 SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided a vehicle external rearview mirror assembly having an extension and retraction mechanism for a pair of telescopic arms that connect a mirror head to a mirror mounting bracket, the assembly comprising:

- 10 a mounting bracket and a mirror head;
- a pair of spaced apart substantially parallel hollow outer arm assemblies extending from the bracket to a distal end, each outer arm assembly having a front portion and a rear portion, the front portion having a rack;
- a pair of spaced apart substantially parallel inner arm assemblies mounted to the head and extending into respective outer arm assemblies for relative sliding movement out of and into respective outer arm assemblies, each inner arm assembly having a body portion joined to the head, the body portion having a front portion and a rear portion;
- a pair of driving pinion gears, each gear rotatably supported within a respective inner arm assembly and engaging a respective rack;
- a pinion drive shaft mounted to the head and extending between the pinion gears along a drive axis substantially perpendicular to the racks;
- a drive motor mounted to the head, the motor having an output shaft; and
- a gear train operatively interposed between the output shaft and the pinion drive shaft,

      wherein the drive motor drives the inner arm assemblies to move telescopically with respect to their respective outer arm assemblies.

      Preferably each outer arm assembly is recessed back from its distal end towards the bracket to allow the drive shaft to travel towards the bracket behind the front portion of the outer arm assembly.

Preferably the mirror assembly further comprises a pair of stability systems, one for each telescopic arm, each stability system comprising:

an inboard contact surface;

an outboard contact surface laterally spaced apart from and outboard of the

5 inboard contact surface with respect to the bracket, both the inboard and the outboard contact surfaces being surfaces of the front portion of a respective inner arm assembly and engaging the front portion of a respective outer arm assembly; and

an intermediate contact surface laterally positioned intermediate the inboard

10 and outboard contact surfaces, the intermediate contact surface being a surface of the rear portion of a respective inner arm assembly and engaging the rear portion of a respective outer arm assembly.

Preferably the intermediate contact surface is a surface of a leg that is hingedly

15 mounted to the inner arm body portion for rotation about an axis substantially parallel to the drive axis of the pinion drive shaft.

Preferably the hinge mount comprises a blade received within a groove, the blade and groove mutually shaped and positioned so as to cause wedging thereby

20 eliminating slop in a direction parallel to the arms.

Preferably the mirror assembly further comprises a spring mounted between the inner arm body portion and the leg to bias the intermediate contact surface into engagement with the rear portion of the outer arm assembly.

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Preferably the intermediate contact surface is a surface of a wheel, the wheel rotatably supported by the leg.

Preferably the front portion of the outer arm assembly comprises a rack

30 member defining said rack and a pair of parallel spaced apart rails located either side of the rack, the rails of the rack engaged by the inboard and outboard contact surfaces to stabilise the inner arm assembly with respect to the outer arm assembly.

At the same time the rails of the rack member control the degree of mesh between the pinion and the rack.

5 Preferably the motor is mounted to the head in such a way as to provide an oldham coupling means, wherein the oldham coupling means reduces side-loadings on the motor shaft.

10 Preferably, when the mirror head is extended, the outboard contact surface moves along the rails outwards to a position beyond the recess. This provides greater stability than would be achieved otherwise.

15 A specific embodiment of the invention will now be described in some further detail with reference to and as illustrated in the accompanying figures. This embodiment is illustrative, and is not meant to be restrictive of the scope of the invention.

#### **DETAILED DESCRIPTION OF PREFERRED EMBODIMENT OF THE INVENTION**

20 A preferred embodiment of the invention is illustrated in the accompanying representations in which:

Figure 1 shows a perspective view of an external rear view mirror assembly according to an embodiment of the invention.

Figure 2a shows an exploded perspective view of the mirror of figure 1.

25 Figure 2b is similar to that of figure 2a but shows the distal end of the assembly in more detail.

Figure 3 is a side view of the assembly shown in figure 1.

Figure 4 is a cross-sectional view through section line A-A illustrated in figure 3.

30 Figures 5a and 5b are sectioned views through section B-B indicated on figure 3 showing the mirror head in a retracted and extended positions respectively.

Figures 5c and 5d are similar view to those of Figure 5a and b, but show an alternative stability component suited to manual telescoping operation.

Figure 6 is a cross-sectional view through section line C-C illustrated in figure 3.

5 Figure 7 is a cross-sectional view through section line D-D illustrated in figure 5a.

Figure 8 shows a more detailed sectional view through section A-A as indicated by arrow E on figure 4.

10 Referring to figure 1, a vehicle external rear view mirror assembly 10 having a head 15 and a bracket 12 is shown. Bracket 12 attaches to the side of a vehicle. The mirror head 15 is telescopically moveable with respect to the bracket 12. Now referring to figures 1 and 2a, the assembly 10 comprises a pair of spaced apart substantially parallel hollow outer arm assemblies 20 and 20' extending from the 15 bracket 12 and a pair of spaced apart substantially parallel inner arm assemblies 40 and 40' mounted to the head 15 and extending into respective outer arm assemblies 20 and 20' for relative sliding movement out of and into them. A pair of driving pinion gears 50 and 50', each rotatably supported within a respective inner arm bodies 41 and 41' engage respective racks 28 and 28' as can be seen in figures 2a, 2b and 8. A pinion drive shaft 53 mounted to the head and extending between the pinion gears 50 and 50' extends along a drive axis which is substantially 20 perpendicular to the rack members 28 and 28'.

Referring now to figure 2b a drive motor 60 mounted to the head 15 is shown.

25 The motor 60 has an output shaft 61 driving through a gear train 63 operatively interposed between the output shaft 61 and the pinion drive shaft 53 (shown in figures 2a, 2b and 4).

Referring to figure 2b and 6, the gear train 63 comprises a worm gear 62, a first 30 gear combination 64, an intermediate gear assembly 65 and a third gear 66. The drive motor 60 drives the inner arm assemblies 40 and 40' to move telescopically with respect to their outer arm assemblies 20 and 20'.

Now referring to figures 5a and 5b, it can be seen that each outer arm assembly 20 has a front portion 24 and a rear portion 26, the front portion 24 having a rack member 28. Each inner arm assembly 40 also has a front portion and a rear portion. The front portion 42' and rear portion 47' of the inner arm 40' are most clearly seen in figure 2b. Reading figures 5a, 5b and 2b together, the pair of stability systems provided by the assembly will now be explained. On the front portion 42' of the inner arm 40' is an inboard contact surface 43' and an outboard contact surface 44'. The outboard contact surface 44' is laterally spaced apart from and outboard of the inboard contact surface 43'. Both contact surfaces 43' and 44' engage the front portion 24' of the outer arm assembly 20'. More Specifically, the contact surfaces 43' and 44' engage contact rails 25' formed on the rear side of the rack member 28'.

An intermediate contact surface in the form of the periphery 36' of a wheel 35', is mounted to the rear portion 47' of the inner arm body 41' at a lateral position intermediate the inboard and outboard contact surface 43' and 44'. The intermediate contact surface, that is the wheel periphery 36', runs along the rear portion 26' of the outer arm 20' as is most clearly shown in figure 5b and in figure 7.

The size and shape of the contact area 43, 43', 44 and 44' can be varied through different embodiments of the invention. With the embodiment illustrated in Figures 1 to 8, the approximate length of the inboard and outboard contact surfaces can be seen from Figures 5a and 5b (43' and 44'). The height of the contact areas is apparent from Figure 8, although, because of the position of the section A-A from which Figure 8 is derived, no contact is shown in this Figure. This is best understood by referring to Figures 5a and 5b which show the lateral positions of the contact areas 43' and 44' and "dip" between them along the inner arm body 41'. The exact shape of the "dip" will depression between the contact areas 43' and 44' and the shape of the transition from the dip upto the contact areas can be varied. For instance, it may be desirable to have a smooth gradual curve transition so that as each contact area "beds-in" and wears, it increases in size, thereby reducing its tendency to wear further.

One of the difficulties in implementing a rack and pinion type drive system inside a dual arm mirror assembly is in transferring drive from a single motor into the arms in a simple way with the minimum number of intermediate drive train components. With the embodiment of the invention shown in the drawings, this has been achieved in part by having the outer arm assembly 20 recessed back from the distal end towards the bracket as is shown in figures 5a and 5b. In particular, referring to figures 5a and 5b, it can be seen that the rear portion 26 of the outer arm is recessed relative to the front portion 24 of the outer arm assembly. This allows the drive shaft 53 to travel towards the bracket 12 behind the front portion 24 of the outer arm assembly 20. This is also apparent from figure 3. The stability system is arranged to take advantage of the resulting geometry. Specifically, the outboard contact surface 44 extends out well beyond the end of the rear portion 26 of the outer arm assembly 20 and the intermediate contact surface 36 rolls almost to the end of the rear portion 26 as is shown in figure 5b.

By supporting the wheel 35 on a leg or carrier 33 that is hingedly mounted for rotation about an axis substantially parallel to the drive axis of the pinion drive shaft 53, "slop" (unwanted lateral movement) can be virtually eliminated in a direction parallel to the arms. This is achieved by having a blade 31' (shown in Figure 5a) extending from the inner arm body 41' projecting into a groove 38' formed by the leg 33'. The wedging action between the blade and the groove eliminates slop.

A coil spring 37' mounted between the inner arm 41' and the leg 33' biases the wheel 35' and hence the intermediate contact surface 36' into engagement with the rear portion 26' of the outer arm assembly.

With this embodiment of the invention, the intermediate contact surface 36 is centrally located between the inboard and outboard contact surfaces 43 and 44. This, combined with the broad 'stance' achieved by the wide spread between the inboard and outboard contact surfaces 43 and 44, results in a very stable arrangement. This is important to minimise the vibration of mirror head and hence the mirror glass. The

design of the stability system is also such that even with substantial manufacturing tolerance, a stability is maintained between the inner and outer arm assemblies

With this embodiment of the invention, the rack 27 is defined by teeth on the 5 rack member 28. This can be seen in figure 2b. The rack member 28 is a separable part of the front portion 24 of the outer arm assembly 20. The rack member 28 has a projection 29 that fits within a hole 23 within the outer tube 21 of the outer arm assembly 20 as shown in figure 2b. In other embodiments of the invention, the rack member 28 may be integral with the outer arm 20.

10

In order to allow the power telescoping mechanism to be manually overridden without damage to the gear train components, a clutch assembly 70 illustrated on figures 8 and 2b is provided. Referring to figure 2b it can be seen that drive from motor 60 through gear train 63 turns gear 66.

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Referring now to figure 8, gear 66 has a clutch drive plate 72 and a clutch drive plate slave 73 clamped to it by disc spring 75. The clutch drive plate 72 is keyed to the shaft 53 since shaft 53 has a square cross-section and the hole through clutch drive plate 72 is a matching shape (best seen in figure 2b). Clutch drive plate slave 73 and clutch drive plate 72 are mutually shaped to prevent relative rotation as can be seen in figure 2b. The friction between the outer periphery of the clutch drive plate and the clutch drive plate slave and the disc surface of gear 66 provides the required drive torque and allows slippage for manual override.

25

Referring to figure 4, it can be seen that the pinion drive shaft 53 is held in place by upper hub 52 and lower hub 54. These hubs also support their respective pinion gears 50 and 50'. The hubs 52 and 54 are keyed to the shaft 53 and rotate within holes within inner arms avoiding the need for conventional bearings. The hubs are tapered on a leading edge allowing for ease of assembly.

30

In an alternative embodiment of the invention, the wheel 35 shown in Figures 5a and 5b can be replaced by a rounded surface on the leg or carrier 33 as show in Figure 5c

and d. This particular arrangement will also be suitable for non power telescoping extendable mirrors whereby the extra friction drag gives the required adjustment retention.

5        While the present invention has been described in terms of a preferred embodiment in order to facilitate better understanding of the invention, it should be appreciated that various modifications can be made without departing from the principles of the invention. Therefore, the invention should be understood to include all such modifications within its scope.

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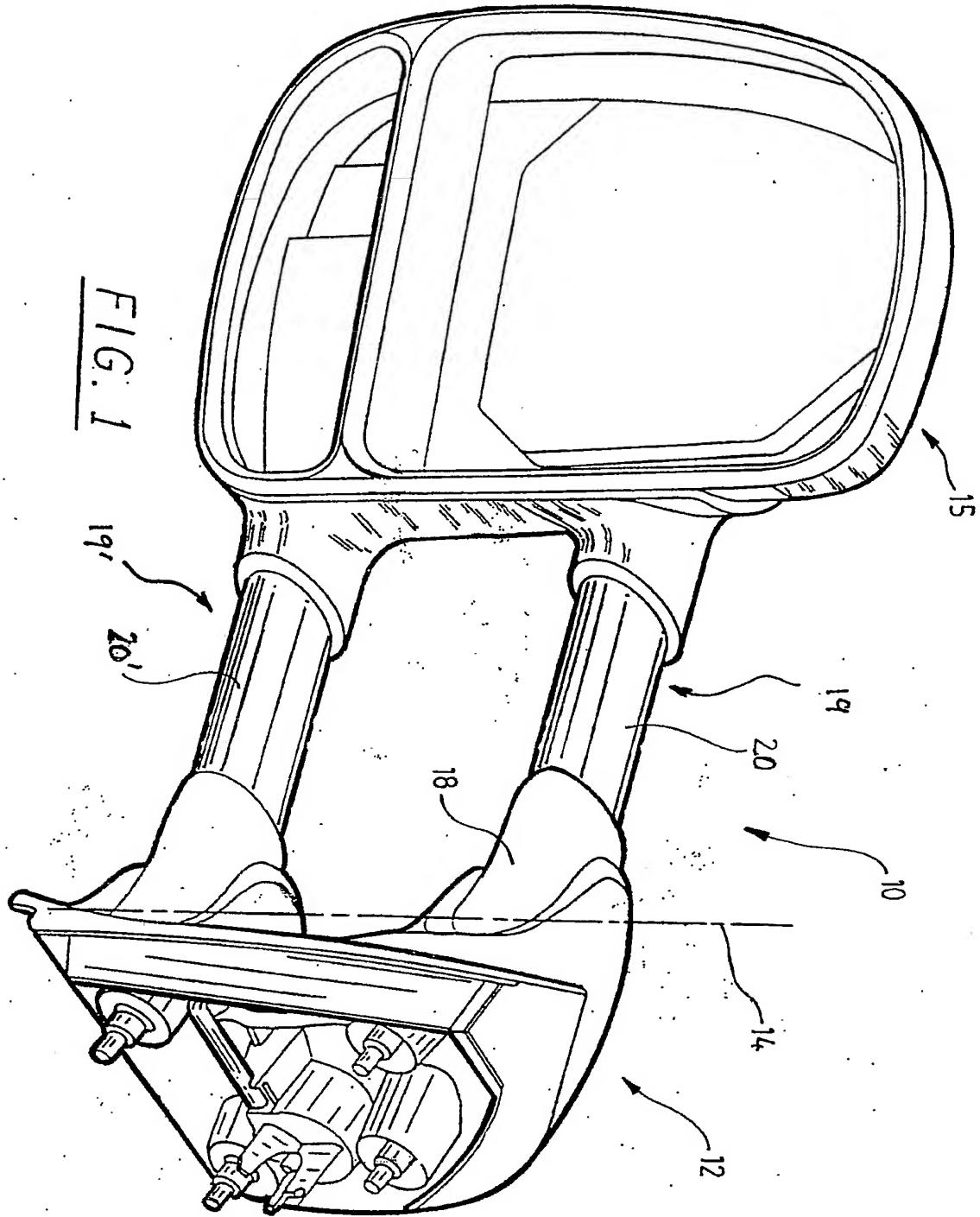
Dated this 28<sup>th</sup> Day of January, 2004

15        Schefenacker Vision Systems Australia Pty Ltd

By its Patent Attorneys

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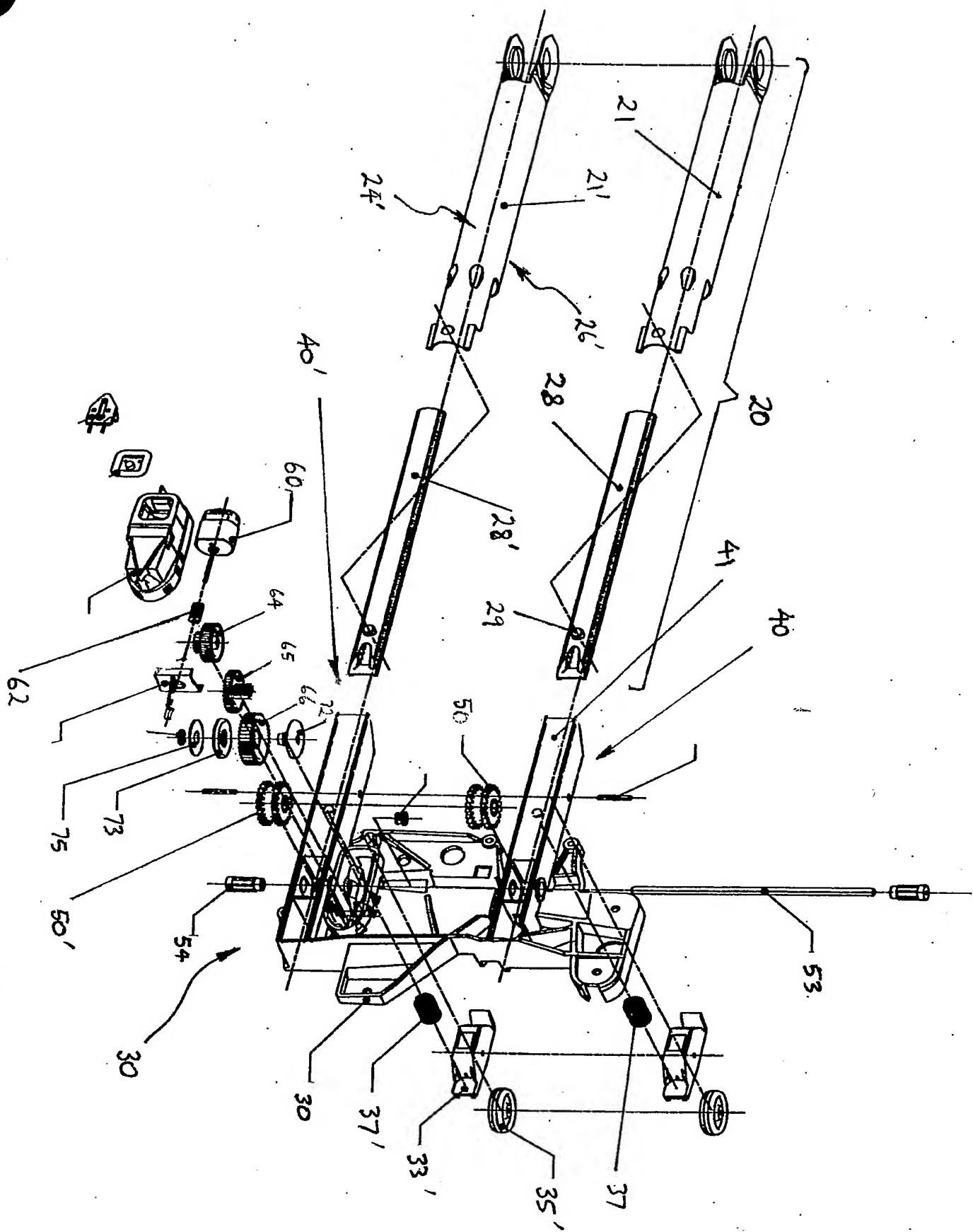


FIG. 2a

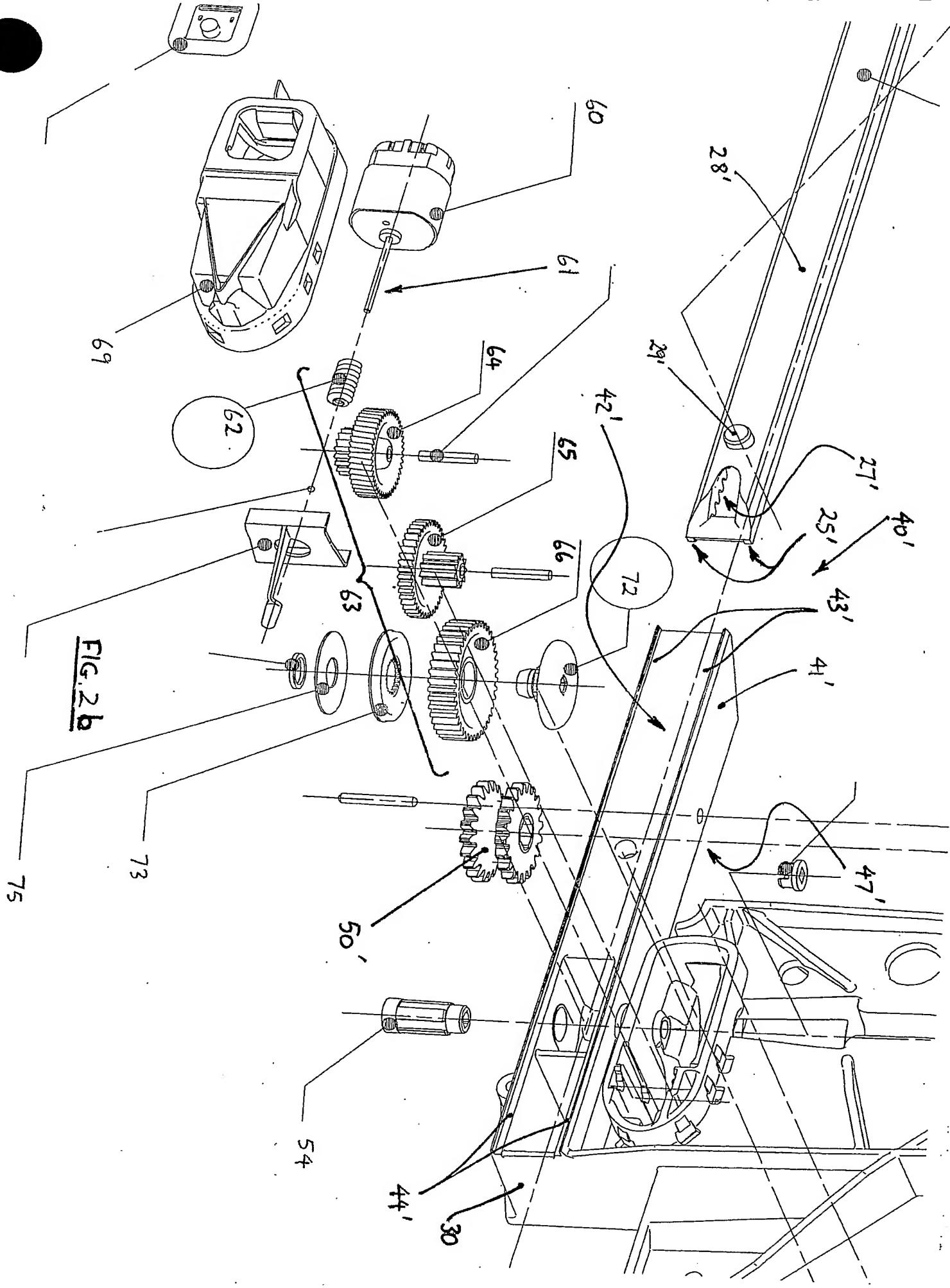
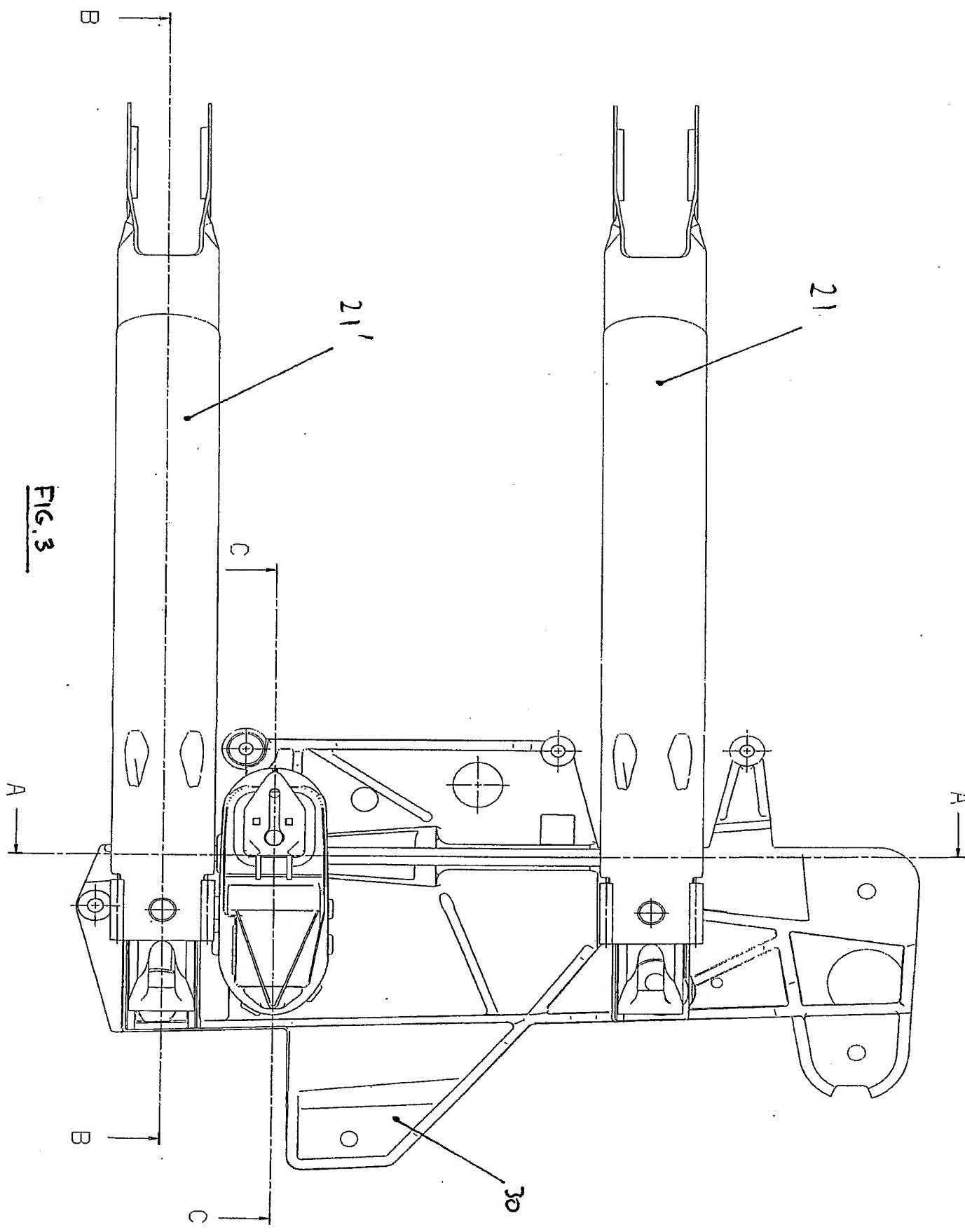
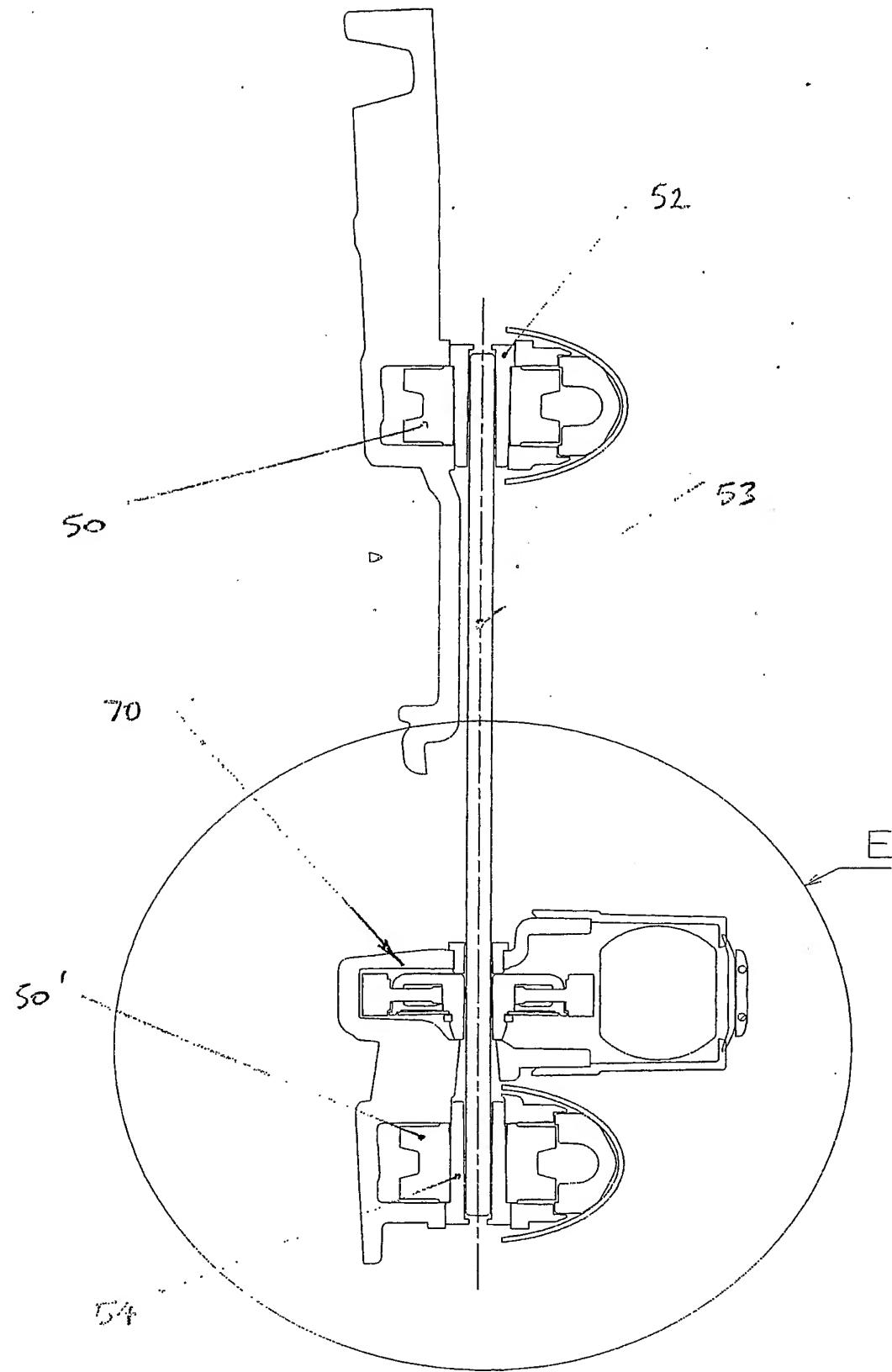


FIG. 2b

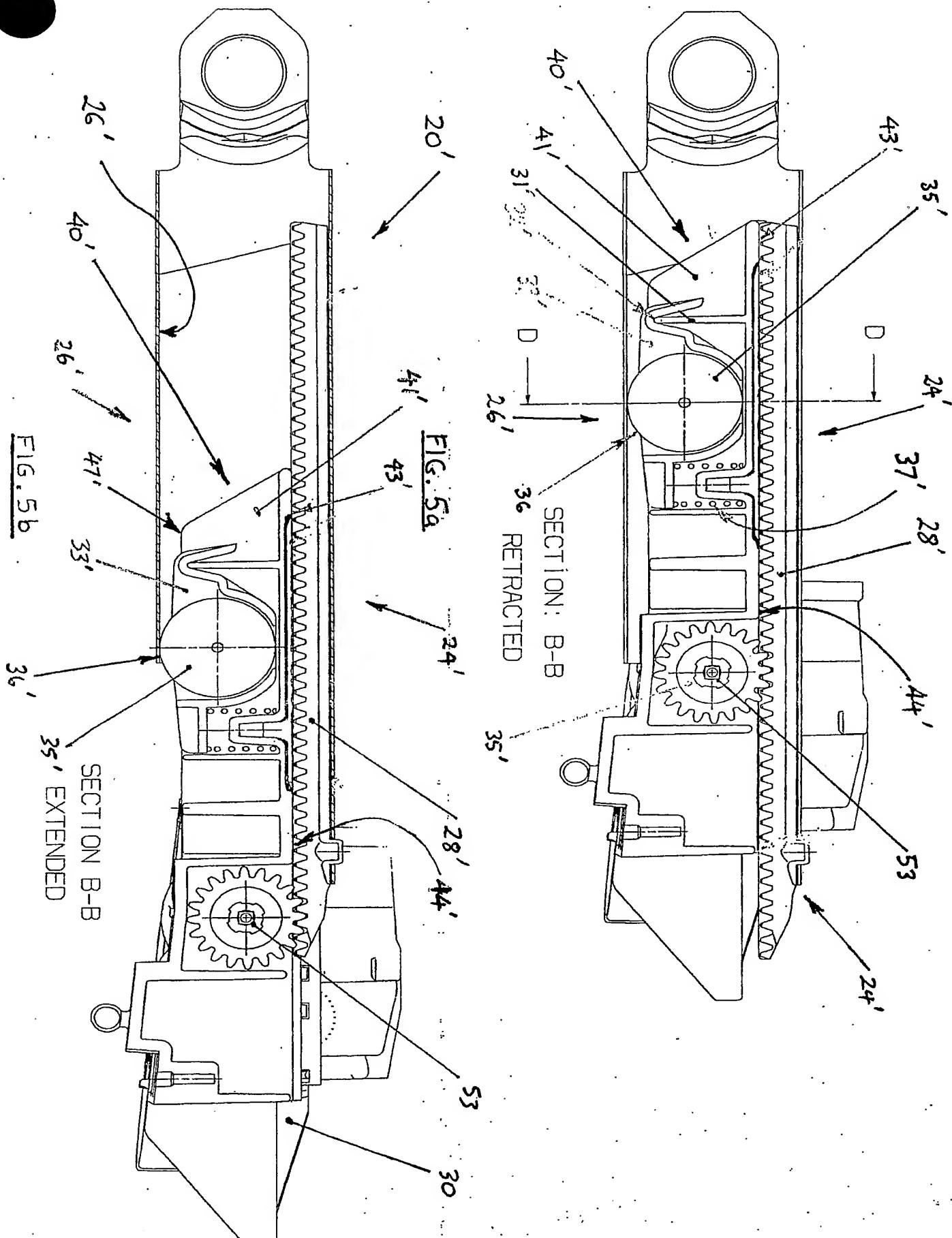
FIG. 3





SECTION: A-A

FIG. 4



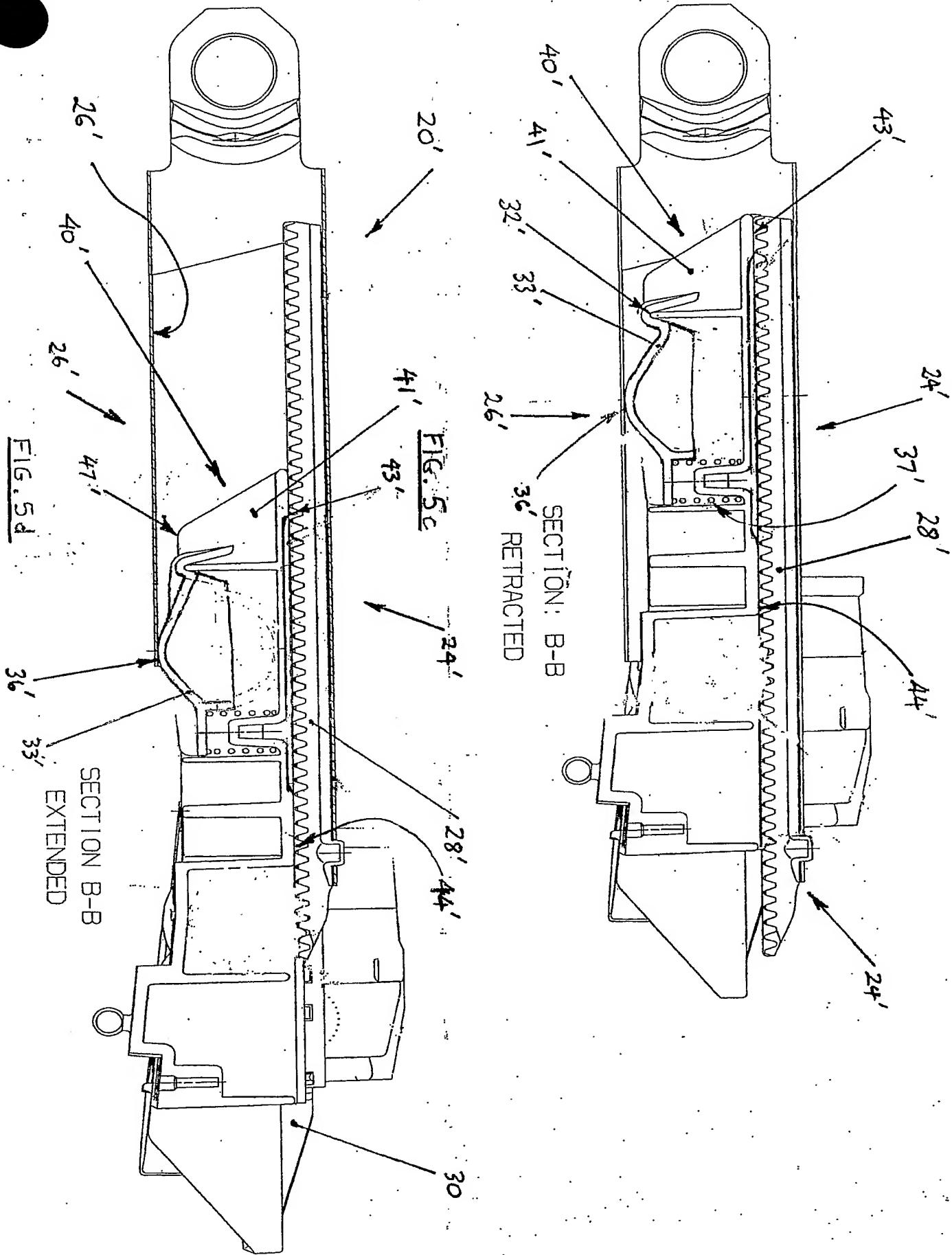
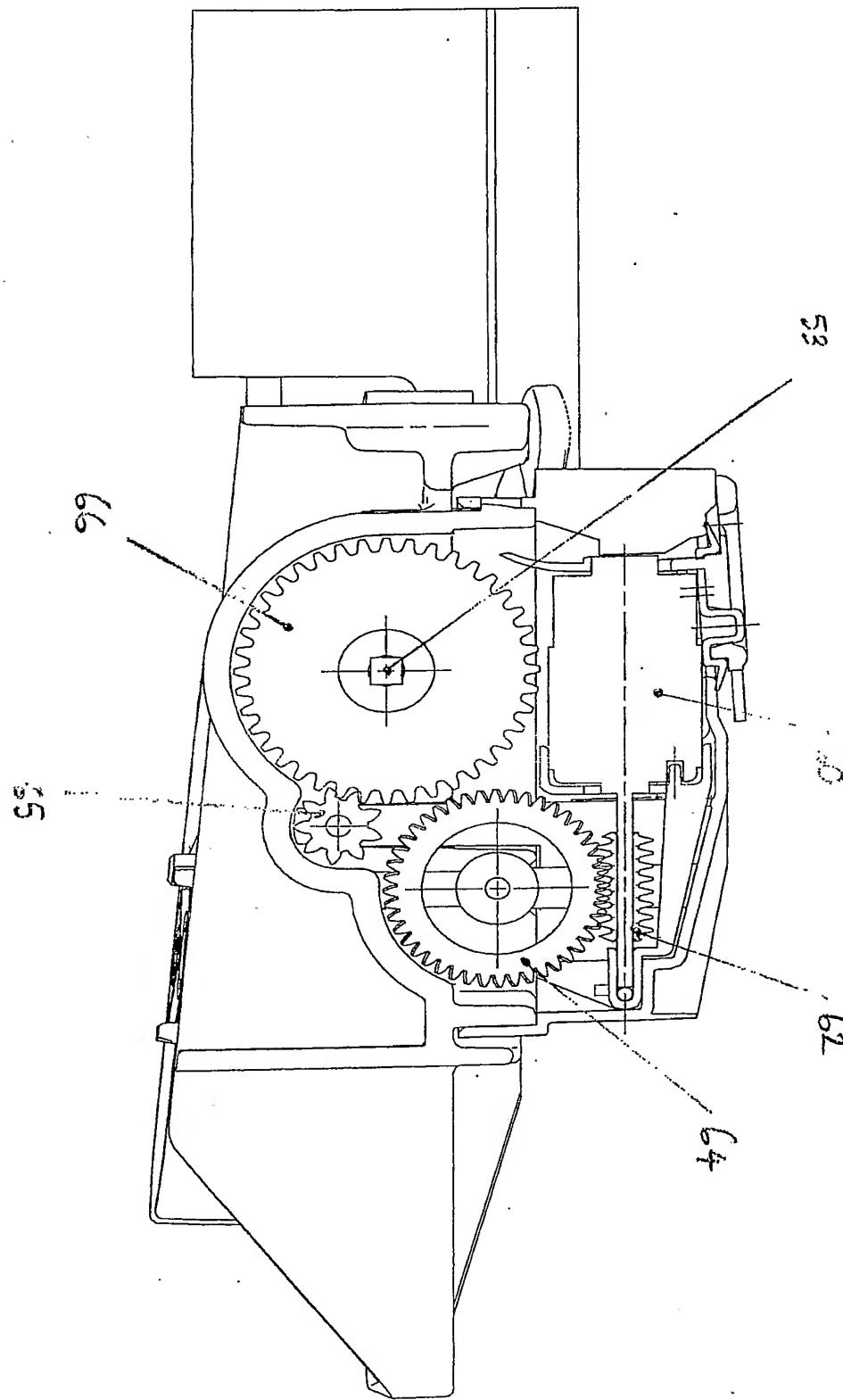
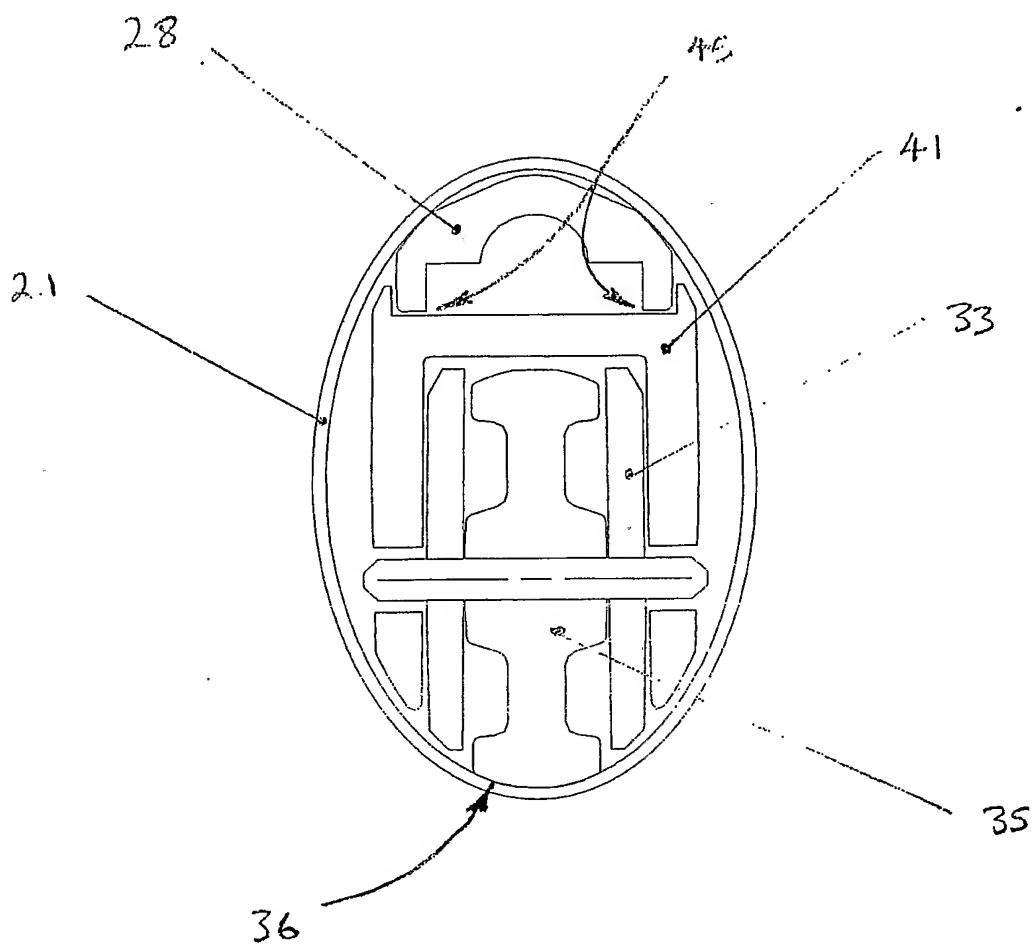


FIG. 6

SECTION: C-C





SECTION: D-D

FIG. 7

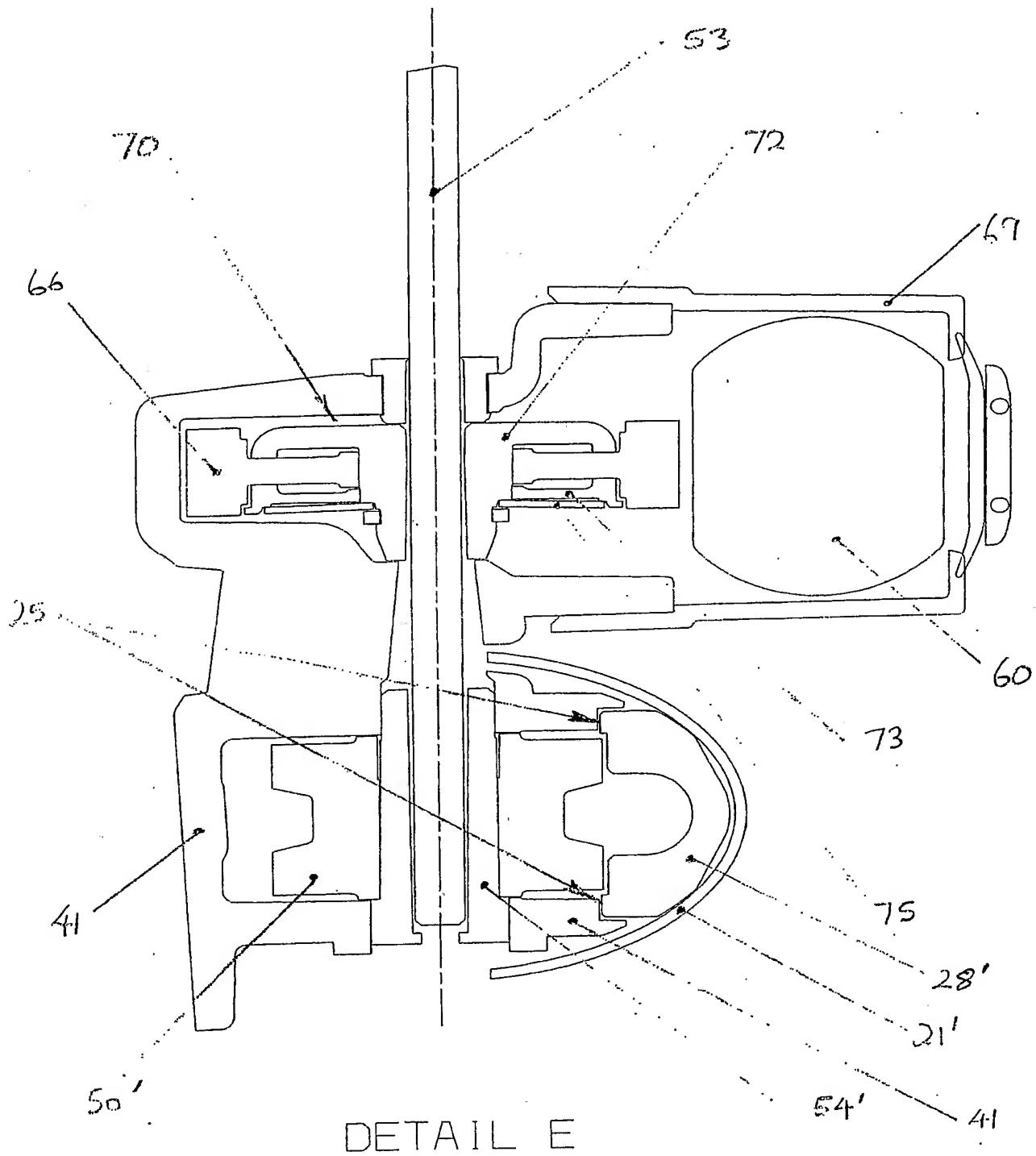


FIG. 8